

SDMS Document ID



1001601

TEREPHTHALIC ACID

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7.0 ENVIRONMENTAL FATE/EXPOSURE POTENTIAL

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SUMMARY ▲

Environmental Fate/Exposure Summary:

Terephthalic acid is likely to enter the environment during production and use in the manufacture of polyester fibers, films, and bottles. If released to soil, terephthalic acid will be lost primarily by biodegradation. The mobility of terephthalic acid in soil is expected to be moderate. If released to water, terephthalic acid may biodegrade. Hydrolysis and photolysis do not appear to be important fate processes in water. Based on the Kow value, the bioconcentration of terephthalic acid in aquatic organisms should not be important. The volatilization of the dissociated and undissociated acid from water will not be important and in most waters terephthalic acid will be found in the dissociated form. If released to air, vapor-phase terephthalic acid may react with photochemically-produced hydroxyl radicals with an estimated half-life of 58 days. Particulate terephthalic acid may be removed from the atmosphere by both wet and dry deposition. Due to its persistence in the atmosphere, terephthalic acid may travel long distances in air. Terephthalic acid has been detected in the ambient air in urban and remote areas, surface water and in certain industrial effluents. The probable routes of worker's exposure to terephthalic acid during its manufacture and use as a chemical intermediate are inhalation and dermal. (SRC) ⚡

POLLUTION SOURCES ▲

Artificial Sources:

1. ... /Terephthalic acid was detected in wastewater sludge/. ... ☞ ☒
2. Since terephthalic acid is commercially produced in large quantities mainly for the production of polyester fibers, films, and bottles(1), it is likely to enter the environment during production or use(SRC). Wastewater samples from a polyester fiber industry were found to contain terephthalic acid(2). The origin of terephthalic acid in polluted rivers in Japan was attributed mainly to anthropogenic sources since the terephthalic acid was found to be present in polluted river waters from the Tokyo area and not in unpolluted waters from other parts of Japan(3). Most of the airborne terephthalic acid in a relatively unpolluted mountainous region of Japan was produced by the photochemical oxidation of anthropogenic compounds (e.g., p-xylene) during long range transport(4). ☞ ☒

ENVIRONMENTAL FATE ▲

1. TERRESTRIAL FATE: A biodegradation test with soil suspension, as determined by a spectrophotometric technique, determined that terephthalic acid will completely degrade within 2 days based on total loss of ultraviolet absorbancy at a wavelength of 260nm(1). Terephthalic acid may also anaerobically biodegrade slowly in subsurface soil(2). The estimated Koc value of 290(3,SRC) for undissociated terephthalic acid indicates that it would have moderate mobility in soil(4). ☞ ☒
2. AQUATIC FATE: In screening tests, terephthalic acid was found to be biodegradable, particularly when the microorganisms in aquatic media are adapted to the compound(1-4). No quantitative data are available for the rate of biodegradation of terephthalic acid in natural water. The loss of terephthalic acid from water due to photolysis and hydrolysis does not appear to be important(5-6). The loss of terephthalic acid from water due to volatilization is not important(7,SRC). The estimated Koc of 290(7,SRC) suggests some undissociated terephthalic acid may be removed from water by adsorption onto suspended solids and sediment(8,SRC). However in most waters terephthalic acid will be found in the dissociated form. The estimated bioconcentration factor of 19(7,SRC) indicates that bioconcentration of terephthalic acid by aquatic organisms should not be important(SRC). ☞ ☒
3. ATMOSPHERIC FATE: Atmospheric terephthalic acid has been found both in vapor and particle phases(2-4). Terephthalic acid in the vapor phase will react with photochemically produced hydroxyl radicals with an estimated half-life of 58 days(1,SRC). Particulate phase terephthalic acid may be removed from the atmosphere both by dry and wet deposition(5). Because of the atmospheric persistence, terephthalic acid is likely to undergo long range transport to remote areas(4,6,SRC). ☞ ☒

ENVIRONMENTAL TRANSFORMATIONS ▲

Biodegradation:

1. In Japanese MITI tests conducted under aerobic conditions with activated sludge as inoculum, terephthalic acid at an initial concn 100 mg/l was found to be biodegradable(1,2,7). On the other hand, other investigators found terephthalic acid to be non-biodegradable under Japanese MITI test conditions(4). Adaptation of microorganisms accelerates the biodegradation of terephthalic acid(3). At the end of 24 days of acclimation of activated sludge, 96% of

terephthalic acid at an initial concn 1000 mg/l of COD biodegraded in 4 hrs(3). Terephthalic acid was determined to be biodegradable under other biodegradation screening test conditions (e.g., French AFNOR, OECD, Zahn-Wellens and Closed Bottle)(4). Complete loss of terephthalic acid occurred in 2 days from a soil suspension inoculum containing 20 ppm of the compound(5). Limited anaerobic biodegradation of terephthalic acid appeared to have occurred when industrial waste containing the compound was injected into a subsurface aquifer(6). ⚠

2. A strain of *Mycobacterium lacticolum* /that can/ degrade ... terephthalic acid was isolated from terephthalate containing industrial sewage. ... ⚠

Abiotic Degradation:

Terephthalic acid does not contain any hydrolyzable functional group(1). Therefore, hydrolysis of terephthalic acid should not be important. Direct photolysis of terephthalic acid in the environment has been assessed to be unimportant(1). The rate constant for the vapor-phase reaction of terephthalic acid with photochemically produced hydroxyl radicals has been estimated to be 2.8×10^{-13} cu cm/molecule-sec(2,SRC). This rate constant corresponds to a half-life of 58 days at a daily average atmospheric hydroxyl radical concn of 5×10^5 hydroxyl radicals per cu cm(2,SRC). The rate constant for the reaction of photochemically produced OH radicals with terephthalic acid in water at pH 9 has been estimated to be 3.2×10^{-9} L/mole-sec(3). Based on a hydroxyl radical concn of 3×10^{-17} mole/L in natural eutrophic waters, this reaction will not be important in water(SRC). ⚠

ENVIRONMENTAL TRANSPORT ▲

Bioconcentration:

Based on a log Kow of 2.00(1) and a regression equation(2), the bioconcentration factor for undissociated terephthalic acid in aquatic organisms can be estimated to be 19(SRC). Therefore, bioconcentration of undissociated terephthalic acid in aquatic organisms may not be important(SRC). ⚠

Soil Adsorption/Mobility:

The dissociation constants pK1 and pK2 for terephthalic acid at 25 deg C are 3.54 and 4.46, respectively(1). Therefore, in most natural waters and soils where the pH is close to neutral, terephthalic acid will exist predominantly in the ionic form(SRC). Ionic compounds may be adsorbed to soil, and suspended solids and sediment in water by ion exchange or adsorption at mineral surfaces(2). However, the mechanism of adsorption of undissociated terephthalic acid is expected to be similar to covalent organic compounds and can be estimated by regression equations(4). Based on a log Kow of 2(3) and a regression equation(4), the estimated Koc value for undissociated terephthalic acid is 290 (SRC). According to a suggested classification scheme(5), the estimated Koc value indicates that undissociated terephthalic acid will exhibit medium mobility in soil(SRC). ⚠

Volatilization from Soil/Water:

The dissociation constants pK1 and pK2 for terephthalic acid at 25 deg C are 3.54 and 4.46, respectively(1). Therefore, in most natural waters where the pH is close to neutral, terephthalic acid will exist predominantly in the ionic forms(SRC). Ionic compounds are not known to volatilize from water(SRC). Based on an estimated Henry's Law constant of 3.88×10^{-3} atm cu m/mole at 25 deg C(2), terephthalic acid will not volatilize from water(3,SRC). ☹ ☹

ENVIRONMENTAL CONCENTRATIONS ▲

Water Concentrations:

1. SURFACE WATER: Terephthalic acid was detected in the concn range 1.1 ppb to 3.4 ppb in a polluted river water in Japan, but none was detected in unpolluted waters(1). ☹ ☹
2. DRINKING WATER: Terephthalic acid was qualitatively detected in a drinking water concentrate from Seattle, WA collected during 1976(2). ☹ ☹

Effluents Concentrations:

Terephthalic acid was detected at a concn of 5.3 ppb in the effluent of night soil treatment plant in Japan(1). The concn of terephthalic acid in the waste water from a dimethyl terephthalate manufacturing plant was 459 mg/L(2). ☹ ☹

Atmospheric Concentrations:

1. URBAN/SUBURBAN: Terephthalic acid was qualitatively detected in the gas phase of urban air from Belgium(1). It was also qualitatively detected in the air particulate matter collected from Tokyo, Japan(2). Terephthalic acid was detected in atmospheric aerosol and in rainwater particle extracts from West Los Angeles, CA(3). Samples of urban aerosols over West Los Angeles, Downtown Los Angeles, Pasadena, Riverside, and San Nicholas Island (July-Dec) contained terephthalic acid at annual average concentrations of 1.3, 2.8, 1.5, 0.88, and less than 0.03 ng/cu m, respectively(4). ☹ ☹
2. RURAL/REMOTE: The average concns of terephthalic acid in the airborne aerosols from two relatively unpolluted mountainous regions of Japan were 11.1 ng/cu m and 3.9 ng/cu m(1). ☹ ☹

HUMAN EXPOSURE ▲

Probable Routes of Human Exposure:

1. Since terephthalic acid is commercially produced mainly for the production of polyester fibers, films, and bottles(1), the probable routes of exposure are inhalation of dust and skin absorption of the compound during its production, use and disposal(SRC). ☹ ☹
2. NIOSH (NOES Survey 1981-1983) has statistically estimated that 3,662 workers are potentially exposed to terephthalic acid in the USA(1). ☹ ☹